Remarks

Reconsideration of the subject application is requested in view of the foregoing amendments and the following remarks.

Claims 20-55 are pending. In this paper, claims 20, 28, and 55 are canceled without prejudice and replaced with new claims 56-58, respectively; claims 21-27, 29-36, 38, 41, 43, 45, 47, and 49 are amended to reflect the change in respective independent claims; and claims 39-40, 42, 44, 46, 48, and 50-54 are unchanged.

All errors in the specification of which the Applicant and his agent are aware already have been corrected in the record.

Claims 20 and 25-26 stand rejected under 35 U.S.C. §102(b) by Palmer. This rejection is traversed.

Claim 20 has been replaced herein with new claim 56. New claim 56 is directed to, *inter alia*, an optical imaging system configured to form an image of an object. The optical imaging system comprises a catadioptric optical system having an optical axis and a refractive optical system situated downstream of the catadioptric optical system along the optical axis. The catadioptric optical system is configured to form an intermediate image of a predetermined area of the object, wherein the predetermined area of the object and the intermediate image are displaced from the optical axis on first and second sides, respectively, of the optical axis in a manner by which light flux propagating to the catadioptric optical system from the object is separated from light flux propagating downstream of the catadioptric optical system to the refractive optical system. The refractive optical system is configured to form an image of the intermediate image, wherein the image formed by the refractive optical system is displaced from the optical axis. At least one of the catadioptric optical system and the refractive optical system includes an aspheric optical surface.

Palmer discusses catadioptric lens systems that include a primary mirror 1, a secondary mirror 2, and multiple lenses downstream of the secondary mirror. Generally, catadioptric lens systems require that the light flux propagating toward the reflective mirror be separated from the light flux reflected by the mirror. Any of several techniques can be used for performing that separation. A first technique involves using a beam splitter to split these two light fluxes on the basis of either their amplitude or polarization. This first technique is not used in Palmer (but is

used in the Ishiyama reference discussed later below). Rather, Palmer utilizes a second technique called a "center-shielding" technique. Light from a distance object (situated effectively at infinity from the optical system) located on the optical axis propagates along the optical axis to the optical system. A central region of the light flux entering the optical system and propagating to the primary mirror 1 is blocked or shielded, and the light reflected from the primary mirror 1 is directed to the secondary mirror 2 located axially on the central shield. The secondary mirror 2 reflects the light to a downstream lens or lenses. Thus, light propagating to the primary mirror 1 is separated from light reflected by the primary mirror 1. In Palmer, as noted above, the object (located an effectively infinite distance from the primary mirror 1) is located <u>on</u> the optical axis, and the intermediate image I also is located <u>on</u> the optical axis. Thus, Palmer does <u>not</u> disclose a system: (1) that forms an intermediate image of a predetermined area of an object that is <u>displaced</u> from the optical axis, (2) in which the intermediate image formed by the system is <u>displaced</u> from the optical axis, and (3) of which the refractive optical system forms an image (of the intermediate image) that is <u>displaced</u> from the optical axis.

In addition, since the Palmer system is located entirely on its optical axis, Palmer does not provide any teaching, suggestion, or motivation of achieving the instantly claimed separation of light fluxes. Specifically, new claim 56 involves a different manner of separating a light flux propagating from the object toward the catadioptric optical system from the light flux propagating from the catadioptric optical system to the refractive optical system. Namely, in claim 56, the predetermined area of the object is displaced from the optical axis on a first side of the optical axis. Optical-path separation is achieved by forming (using the catadioptric optical system) an intermediate image (of the predetermined area of the object) that is <u>displaced</u> from the optical axis on a second side of the optical axis. Thus, light flux propagating to the catadioptric optical system from the object is separated from light flux propagating downstream of the catadioptric optical system to the refractive optical system. As a result of this manner in which light fluxes are separated, resulting in displacement of the intermediate image from the optical axis, the light flux propagating from the catadioptric optical system through the refractive optical system forms an image that also is displaced from the optical axis. Palmer does not teach or suggest this manner or provide any information to the person of ordinary skill that would provide any motivation to derive the combinations of features recited in claim 56 and its dependents.

Claims 25 and 26 depend from claim 56 and are allowable over Palmer for the same reasons as claim 56 and also because each of these dependent claims recites a respective independently patentable combination of features.

Therefore, claims 56 and 25-26 are properly allowable over Palmer, and action to such end is requested.

Claims 20, 25-26, and 55 stand rejected for alleged obviousness from Moskovich in view of Palmer. This rejection is traversed.

The recitations of claim 56 (replacing claim 20) are summarized and discussed above. Similar to Palmer, Moskovich also utilizes the "center-shielding" technique of separating light fluxes. Light from a distant object (situated effectively at infinity from the Moskovich zoom lens) located on the optical axis propagates along the optical axis to the zoom lens. A central region of the light flux entering the zoom lens and propagating to the primary mirror M1 is blocked or shielded, and the light reflected from the primary mirror M1 is directed to the secondary mirror M2 located axially on the central shield. The secondary mirror M2 reflects the light to downstream lenses. Thus, light propagating to the primary mirror M1 is separated from light reflected by the primary mirror M1. In Moskovich the object (located an effectively infinite distance from the primary mirror M1) viewed by the zoom lens is located on the optical axis, and the intermediate image I also is located on the optical axis. Thus, Moskovich does not disclose a system: (1) that forms an intermediate image of a predetermined area of an object that is displaced from the optical axis, (2) in which the intermediate image formed by the system is displaced from the optical axis, (3) of which the refractive optical system forms an image (of the intermediate image) that is displaced from the optical axis, and (4) that achieves separation of the light fluxes in the manner claimed. In addition, since the Moskovich zoom lens as well as the object and image are fully centered on the optical axis, Moskovich does not provide any teaching, suggestion, or motivation of configuring a catadioptric system in the manner that is instantly claimed so as to achieve the claimed flux separation. These shortcomings of Moskovich are not fulfilled by Palmer for reasons discussed above regarding Palmer.

New claim 58, replacing canceled independent claim 55, is directed, *inter alia*, to an optical system configured to form on a surface an image of a predetermined area of an object. The optical system comprises a catadioptric optical system that is situated on an optical axis of the optical system, between the object and a point that is optically conjugate to the object. The

catadioptric optical system is configured such that a light flux propagating from the predetermined area on one side of the optical axis is separated by the catadioptric optical system from a light flux propagating downstream of the catadioptric optical system on a second side of the optical axis. The optical system also includes a refractive optical system that is situated on the optical axis between the catadioptric optical system and the surface. The refractive optical system is configured to form an image of the predetermined area of the object on the surface at a location on the surface that is displaced from the optical axis. Also, at least one of the catadioptric optical system and the refractive optical system includes an aspheric surface.

As discussed above with respect to new claim 56, Moskovich does not disclose an optical system having a refractive optical system situated on the optical axis between the catadioptric optical system and the surface and that is configured to form an image, of the object, on the surface at a location on the surface that is displaced from the optical axis. Moskovich also does not achieve the manner of separation of light fluxes recited in either claim 56 or claim 58. These shortcomings of Moskovich are not fulfilled by Palmer for reasons as discussed earlier above. Also noted is the admission on page 4 of the Office action that "Moskovich does not disclose that one of the catadioptric system and refractive system having one aspheric surface for correcting image aberration." Of course, in view of the other shortcomings of Palmer, this and other deficiencies of Moskovich are not fulfilled by Palmer.

Claims 25 and 26 depend from claim 56 and are allowable over Moskovich and Palmer for the same reasons as claim 56 and also because each of these dependent claims recites a respective independently patentable combination of features.

Therefore, claims 56, 25-26, and 58 are properly allowable over any combination of Moskovich and Palmer, and action to such end is requested.

Claims 20-38 and 45-55 stand rejected for alleged obviousness from Ishiyama and Palmer. This rejection is traversed.

The recitations of new claim 56 (replacing claim 20) and of new claim 58 (replacing claim 55) are discussed above. Independent claim 28 is replaced with new claim 57, which is directed to, *inter alia*; an optical imaging system for forming, on a surface, an image of a predetermined area of an object. The imaging system comprises a catadioptric optical system having an optical axis, and a refractive optical system situated downstream of the catadioptric optical system along the optical axis. The catadioptric optical system comprises a concave

mirror and at least one diverging lens. The catadioptric optical system receives a light flux, from the area of the object located on a first side of the optical axis, and forms from the light flux an intermediate image of the area on a second side of the optical axis, thereby separating the light flux from the area from the light flux reflected from the concave mirror. The diverging lens is arranged such that the light flux from the area of the object propagates through the diverging lens to the concave mirror, and the light flux reflected from the concave mirror propagates through the diverging lens downstream to the refractive optical system. The refractive optical system is configured to form on the surface an image of the intermediate image, wherein the image is displaced from the optical axis. Also, at least one of the catadioptric optical system and the refractive optical system includes an aspheric optical surface.

Ishiyama discusses catadioptric optical systems. As discussed above, whereas catadioptric lens systems generally require that the light flux propagating toward the reflective mirror be separated from the light flux reflected by the mirror, Ishiyama utilizes the first technique, discussed above, for achieving flux separation. Namely, in Ishiyama a beam splitter BS is used to split the two light fluxes, propagating along the optical axis, on the basis of either their amplitude or polarization. By splitting the axially propagating flux in this manner, the skilled person would have understood that the Ishiyama optical system can (and would) use a small-diameter mirror M_1 and small-diameter lenses, and FIGS. 3-5 clearly show such a small mirror M_1 and small lenses (especially relative to the size of the beam splitter BS). Also, FIGS. 1 and 9 depict the object, intermediate image, and image surface (wafer) all being centered on the optical axis. Based on these two figures, Ishiyama as a whole is understood to disclose that the object (R), the intermediate image (I), and the image surface (W) all in fact are centered on the optical axis. FIGS. 3-5 also depict the object (R), intermediate image (I), and image surface (W) all being centered on the optical axis. FIGS. 3-5 also depict multiple bundles of rays (but not all possible rays), including one bundle in each figure that propagates along the optical axis from the object to the intermediate image and to the image surface, again indicating that the object, intermediate image, and image surface are not displaced from the optical axis in the manner instantly claimed. Thus, the Ishiyama optical systems are not understood to achieve displacement of the intermediate image relative to the object in the manner instantly claimed.

These shortcomings of Ishiyama are not fulfilled by Palmer for reasons as discussed earlier above. Also noted is the admission on page 5 of the Office action that Ishiyama does not

suggest "the use of an aspheric surface for one optical element in either the catadioptric system or refractive system for the purpose of correcting the aberrations." Of course, in view of the other shortcomings of Palmer, this and other deficiencies of Moskovich are not fulfilled by Palmer.

Claims 21-27, 29-38, and 45-54 depend from their respective new independent claims and are allowable over Ishiyama and Palmer for the same reasons as new claims 56-58 and also because each of these dependent claims recites a respective independently patentable combination of features.

Therefore, claims 56-58 and claims 21-27, 29-38, and 45-54 are properly allowable over any combination of Ishiyama and Palmer, and action to such end is requested.

Claims 39-44 stand rejected for alleged obviousness from Ishiyama, Palmer, and Shafer and/or Korsch. This rejection is traversed.

Claims 39-44 depend from new claim 56, and are properly allowable over Ishiyama and Palmer for all the reasons discussed above. The shortcomings of Ishiyama and Palmer are not fulfilled by Shafer and/or Korsch, which were cited for their alleged respective discussions of aspheric mirrors. Also, claims 39-44 each recite a respective independently patentable combination of features.

Therefore, claims 39-44 are properly allowable over any combination of Ishiyama, Palmer, Shafer, and Korsch, and action to such end is requested.

Applicant has a right to an interview at this stage of prosecution. If any issues remain unresolved after consideration of the contents of this paper, the examiner is requested to contact the undersigned to schedule a telephonic interview. Any inaction by the examiner to make such contact, followed by issuance of a final action, will be regarded as an acquiescence by the examiner to grant an interview as a matter of right after the final action.

Respectfully submitted,

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